Distributed Energy Evaluation Platform (DEEP)

CPUC Workshop
Tools and Technologies for DR Planning

January 8, 2014

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Introduction

- As Distributed Energy Resources (DERs) continue to grow, it will be important to more accurately assess when and where DERs will be placed
- DER Growth Scenarios: *"As part of the DRPs, the Utilities shall develop three ten-year scenarios that project expected growth of DERs through 2025, including expected geographic dispersion at the distribution substation level and impacts on distribution planning."**
- DER adoption is currently driven largely by economic incentives and consumer choice, with locational value currently difficult to assess
- ICF's approach establishes a common framework to forecast DER growth emphasizing the location and temporal deployment
- This information, in conjunction with locational impact analyses, can be used to determine DER system impacts

*Commissioner Picker's Ruling published on 11/17/2014 (Rulemaking 14-08-013)

Parameters for Optimizing DER

- Number of variables to consider when determining optimal location of DER (big picture questions)
  - Resource cost
  - Locational distribution grid implications
  - Amount and location of DER to be implemented/installed on the grid
- Will require a number of different tools and solutions to address the different parameters
- Developing a robust forecast and understanding the implications on the distributions system are one of the parameters – focus for today
  - Forecasting tool for multiple DER technologies
  - Coordinated control and optimization approach

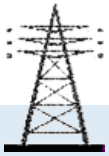
Distributed Energy Evaluation Platform (DEEP)
Analytical Suite of Software Modules

EEPM
Energy Efficiency and Demand Side Management

SolarFlare
Residential Solar PV

CHPower
Fossil fuel-based On-site Generation

EVolve
Electric Vehicle



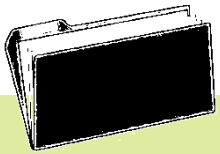
OGrid
Off-Grid Electrification

SmartES
Energy Storage

Market Penetration Analysis

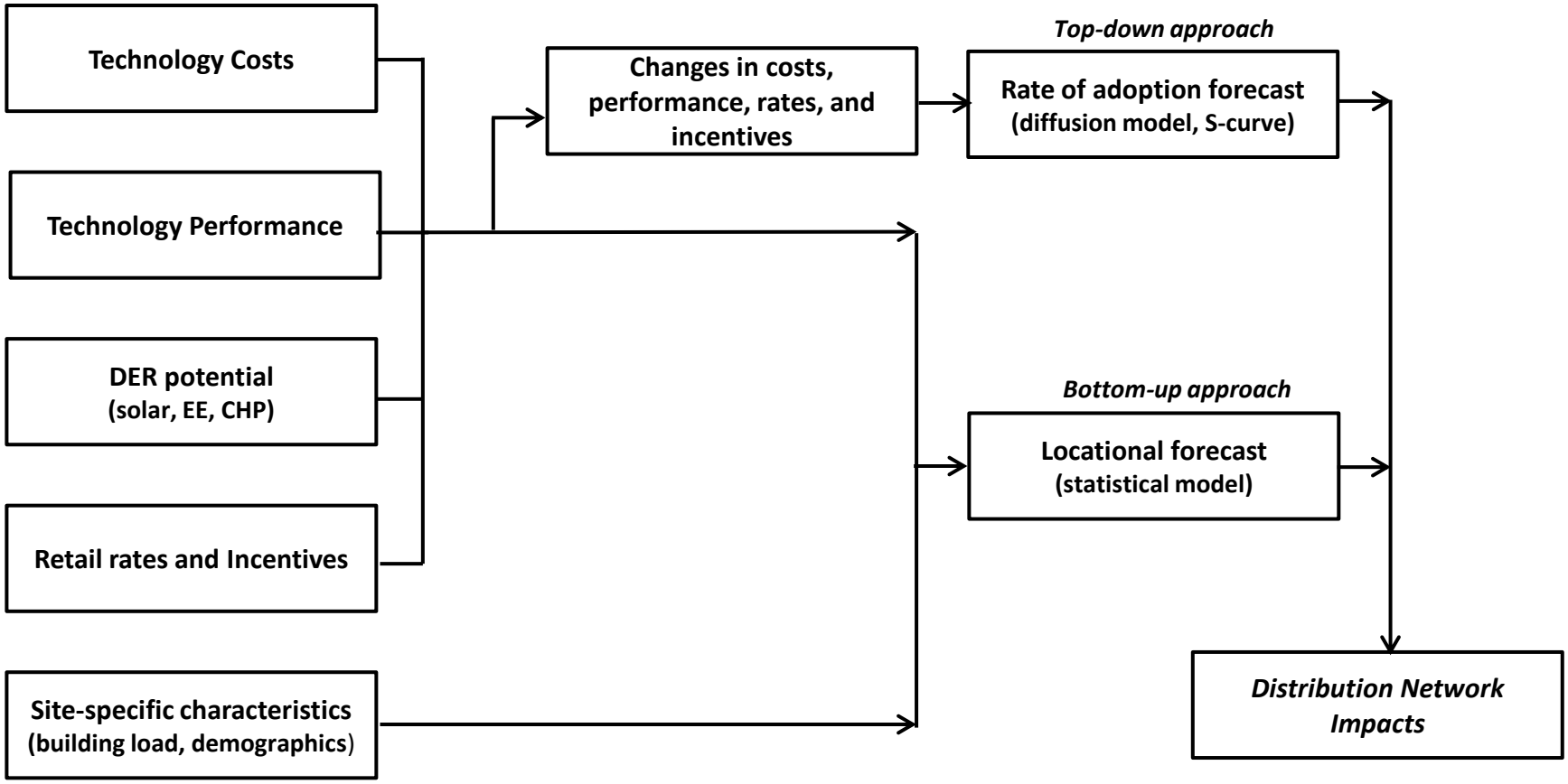
Holistic System Planning

DNA
Distributed Network Analyzer



DPO
DER Portfolio Optimizer

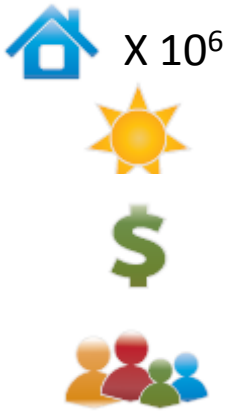
Predictive Model Framework



Solar PV

SolarFlare: A Comprehensive Solar PV Market Analysis Tool

- Projects market adoption of rooftop solar PV and identifies the customers most likely to host rooftop solar PV
- Assesses millions of customers and identifies solar adoption clustering under a variety of market scenarios
- Uses Statistical and Market Diffusion Models, building on a blend of **economic + technical + demographic** data
- Combined Assessment is 3x better in predictive power
- Allows proactive planning in preparation for distributed solar growth

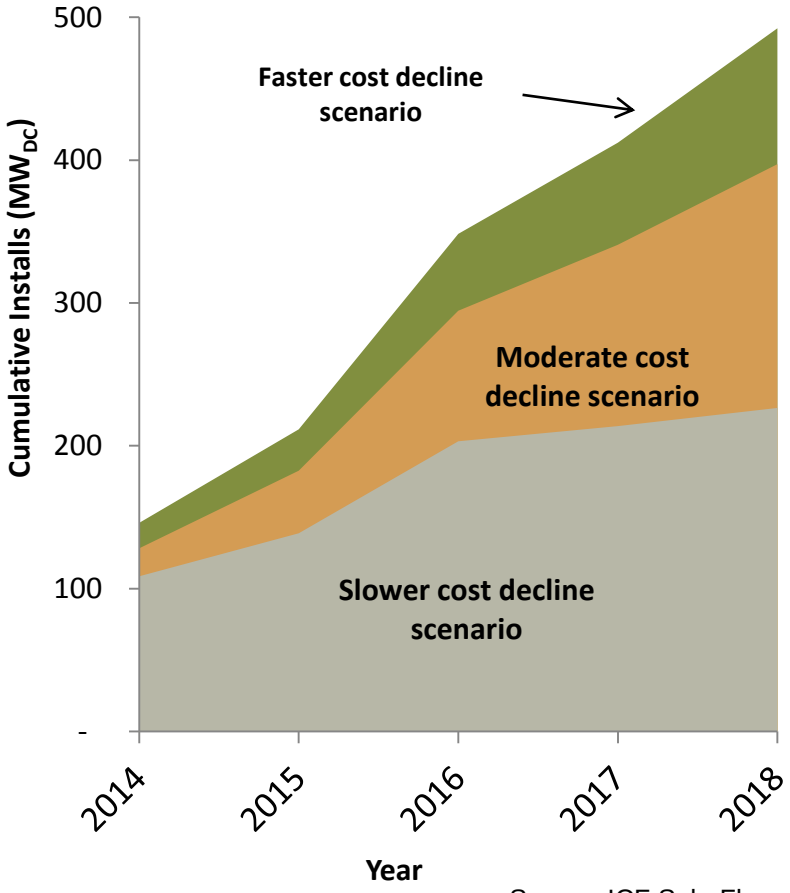


[1] Determined using logistic regression for dozens of variables

Growth of Distributed Solar PV: Annual View

- Results using integrated financial and output modeling
- ICF has specialists across the entire PV project lifecycle to inform values and scenarios
- Variables that can be included (but not limited to):
  - Technology cost and performance
  - Federal & State incentive levels and timing
  - Financing type (self-finance vs. PPA)
  - Interest, discount, and tax rates
  - Retail rate levels & structure
- ICF has tested cost and performance scenarios in prior forecasts

Residential Solar PV Penetration Under Three Illustrative Cost Scenarios

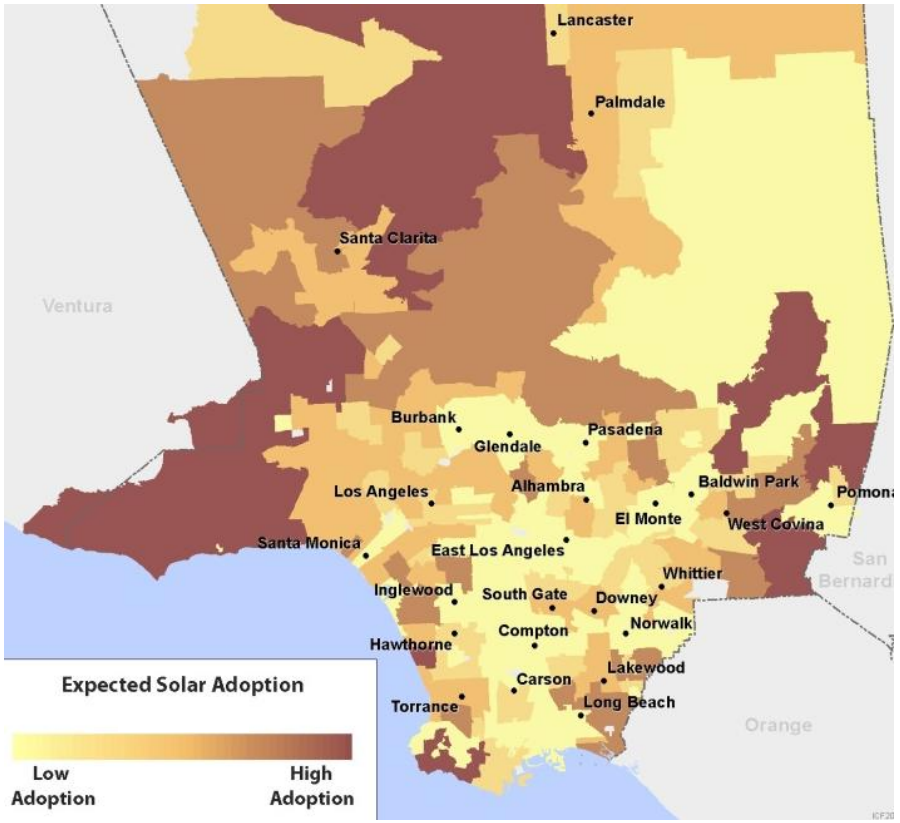


Source: ICF SolarFlare

Growth of Distributed Solar PV: Locational View

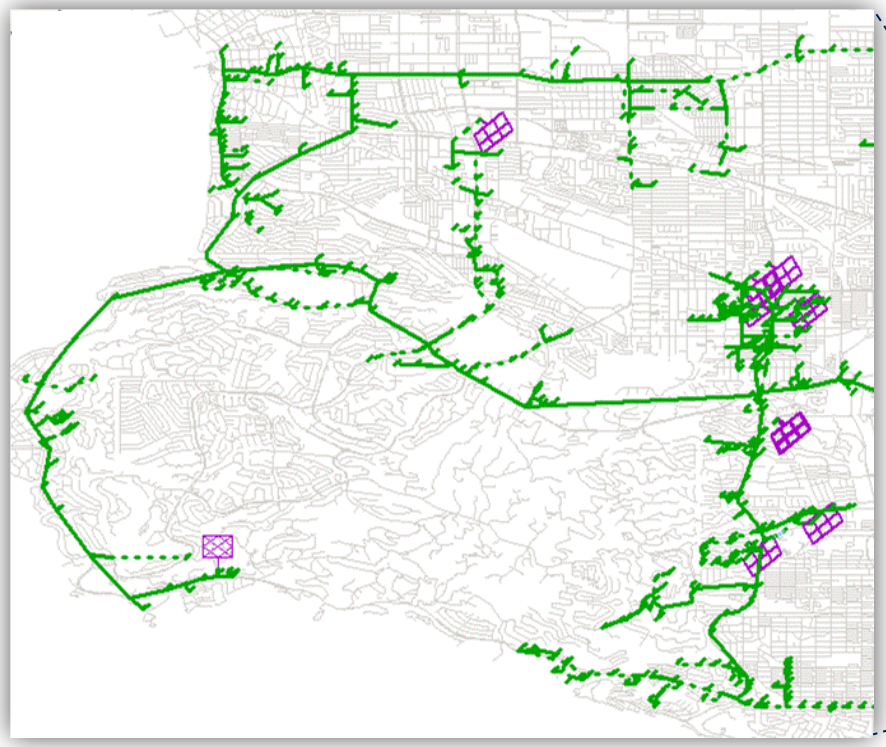
- LA County will see total residential rooftop solar PV installations rise over 12x by 2020
- Solar PV adoption hot spots will vary substantially over time as local incentives and retail rates change
- Demographics, such as wealth and the presence of children, are a key variables influencing likelihood of solar adoption

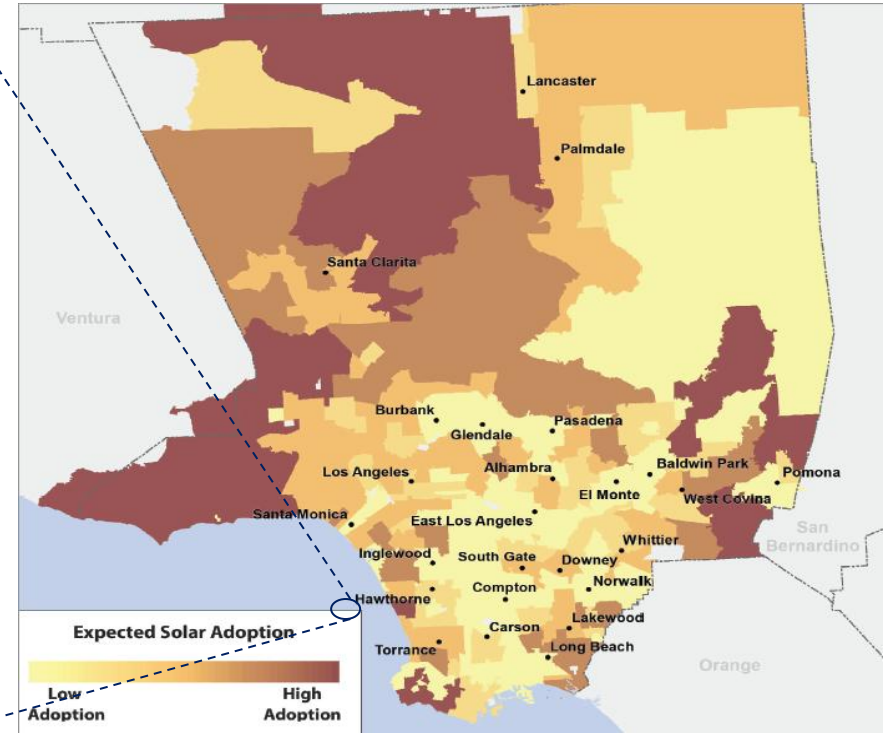
Solar PV Adoption Will be Highly Clustered



Distribution modeling

Time Series Analysis (Typical Summer Day) with Solar PV at High Load Locations – 9 AM (30%)[1]





No voltage violations are observed at 9:00 AM

Low Voltage Violation (<95%)

Normal Voltage (95% - 105%)

High Voltage Violation (>105%)

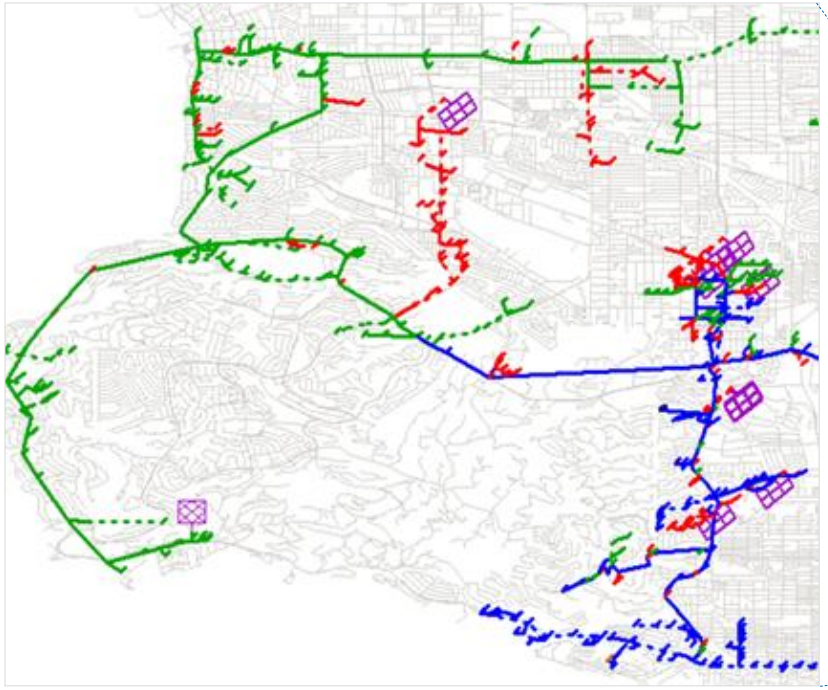
Source or Substation

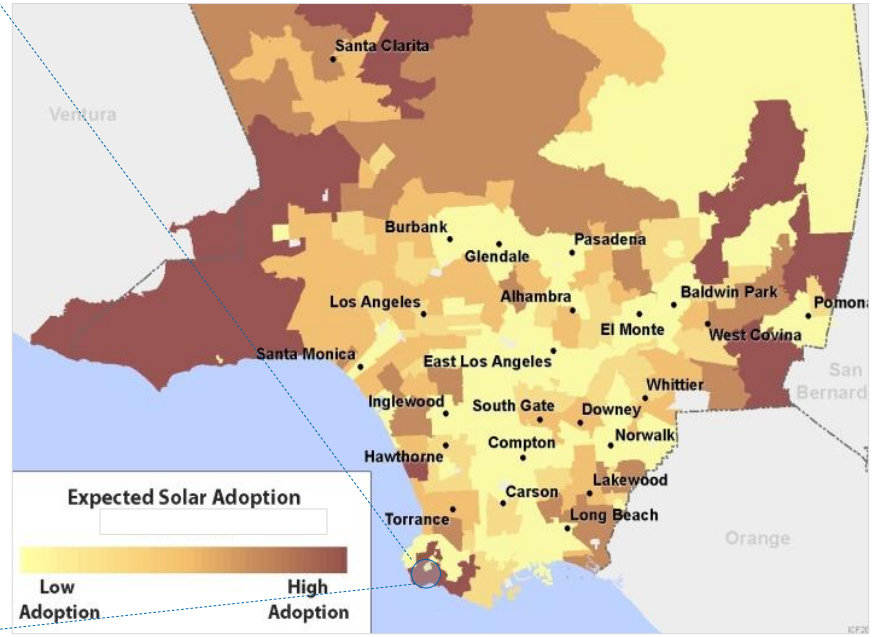
Rooftop Solar PV Arrays

[1]30% measured at 5pm.

Source: ICF DEEP Analysis.

Time Series Analysis (Typical Summer Day) with Solar PV at High Load Locations – 1 PM (30%)[1]





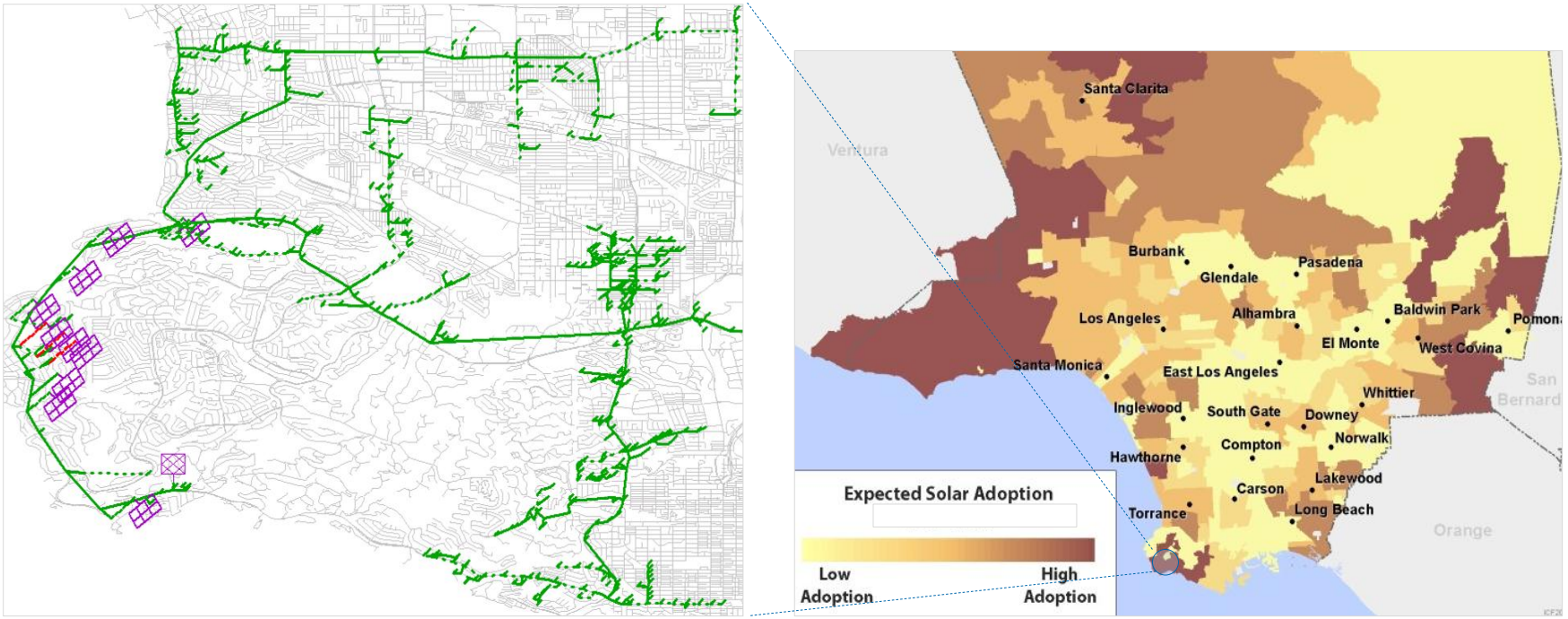
Number of low and high voltage violations are observed at 1:00 pm

Legend

- Low Voltage Violation (<95%)
- Normal Voltage (95% - 105%)
- High Voltage Violation (>105%)
- Source or Substation
- Rooftop Solar PV Arrays

[1]30% measured at 5pm.
Source: ICF DEEP Analysis.

Time Series Analysis (Typical Summer Day) with Solar PV Near to Substation– 1 PM (30%)[1]



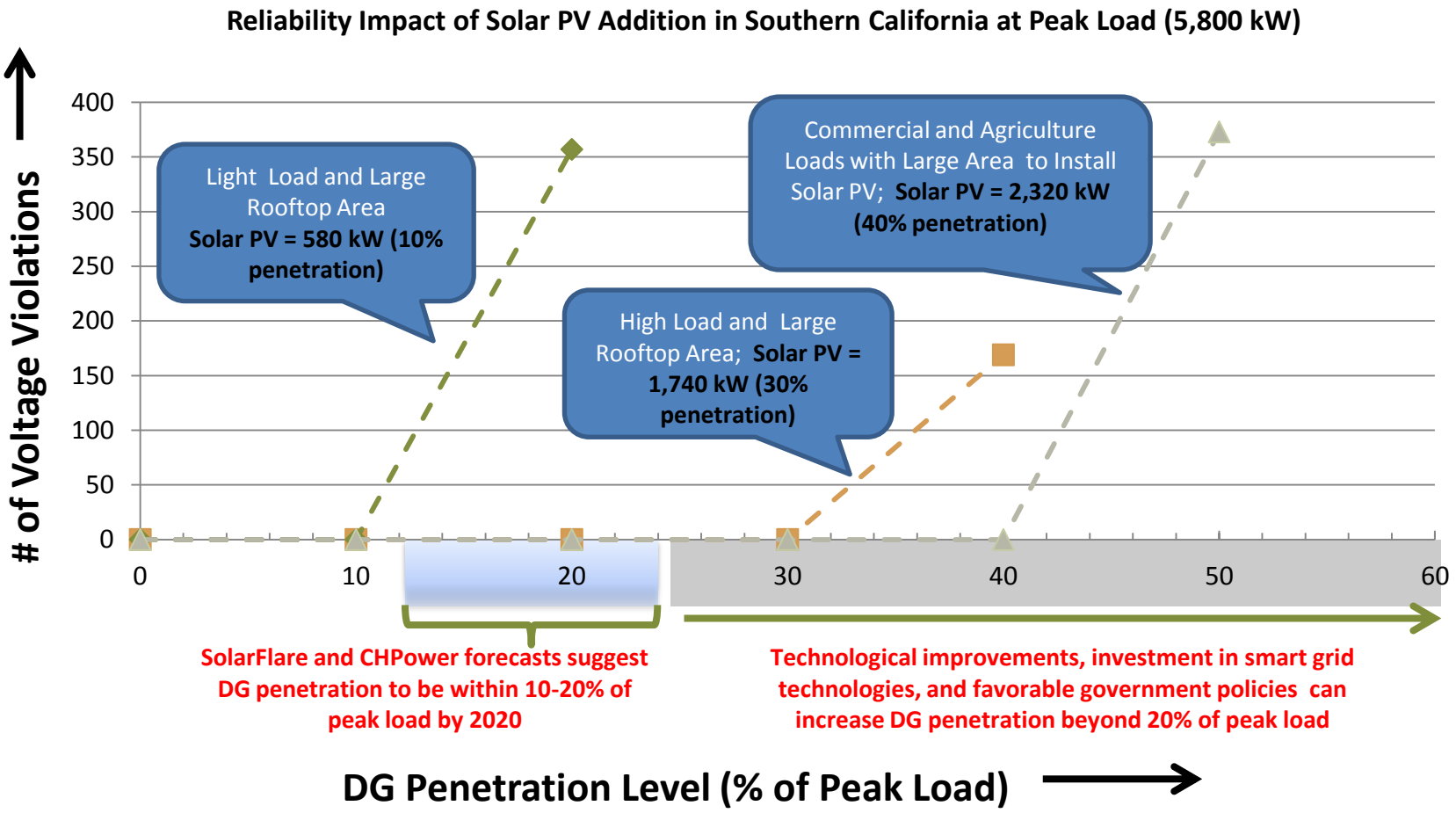
Few high voltage violations are observed at 1:00 pm

Legend

- Low Voltage Violation (<95%)
- Normal Voltage (95% - 105%)
- High Voltage Violation (>105%)
- Source or Substation
- Rooftop Solar PV Arrays

[1]30% measured at 5pm.
Source: ICF DEEP Analysis.

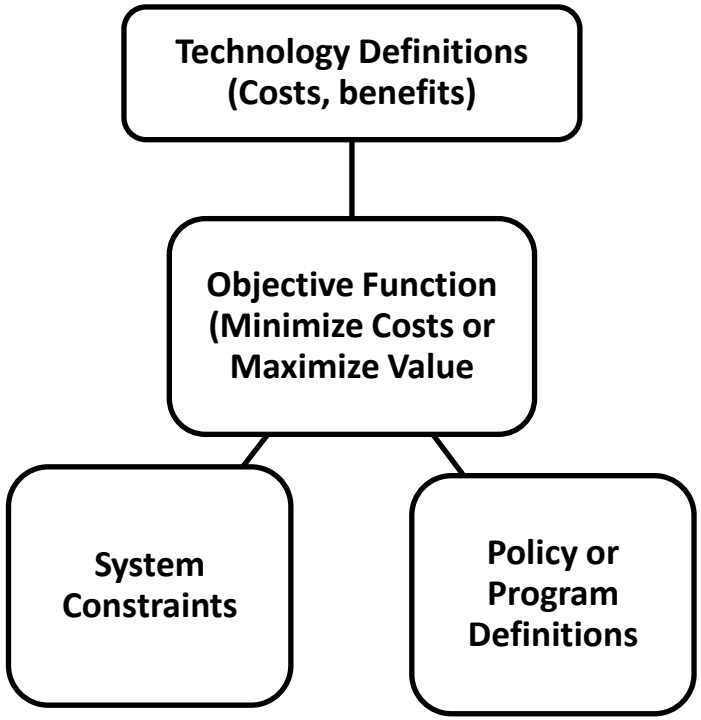
DNA Analysis: Reliability Issues Are Possible Even at Low DER Penetration Rates



Distributed Energy Resource Portfolio Optimizer

- Common platform to evaluate competitiveness across different DERs (technology types)
  - What is the optimal mix of solar PV, CHP, EE, etc. given costs for each technology, the technical constraints presented by the distribution grid, and some objective criteria?
- Establishes a common metric and framework to evaluate benefits and costs across different DERs
- Would allow utility planners to maximize value (or minimize costs) in a defined territory, based on customizable criteria

Conceptual Framework



Voltage Management: a Coordinated Control and Optimization Approach

CPUC Workshop:
Tools and Technologies for Distribution Resources Planning

January 8, 2015

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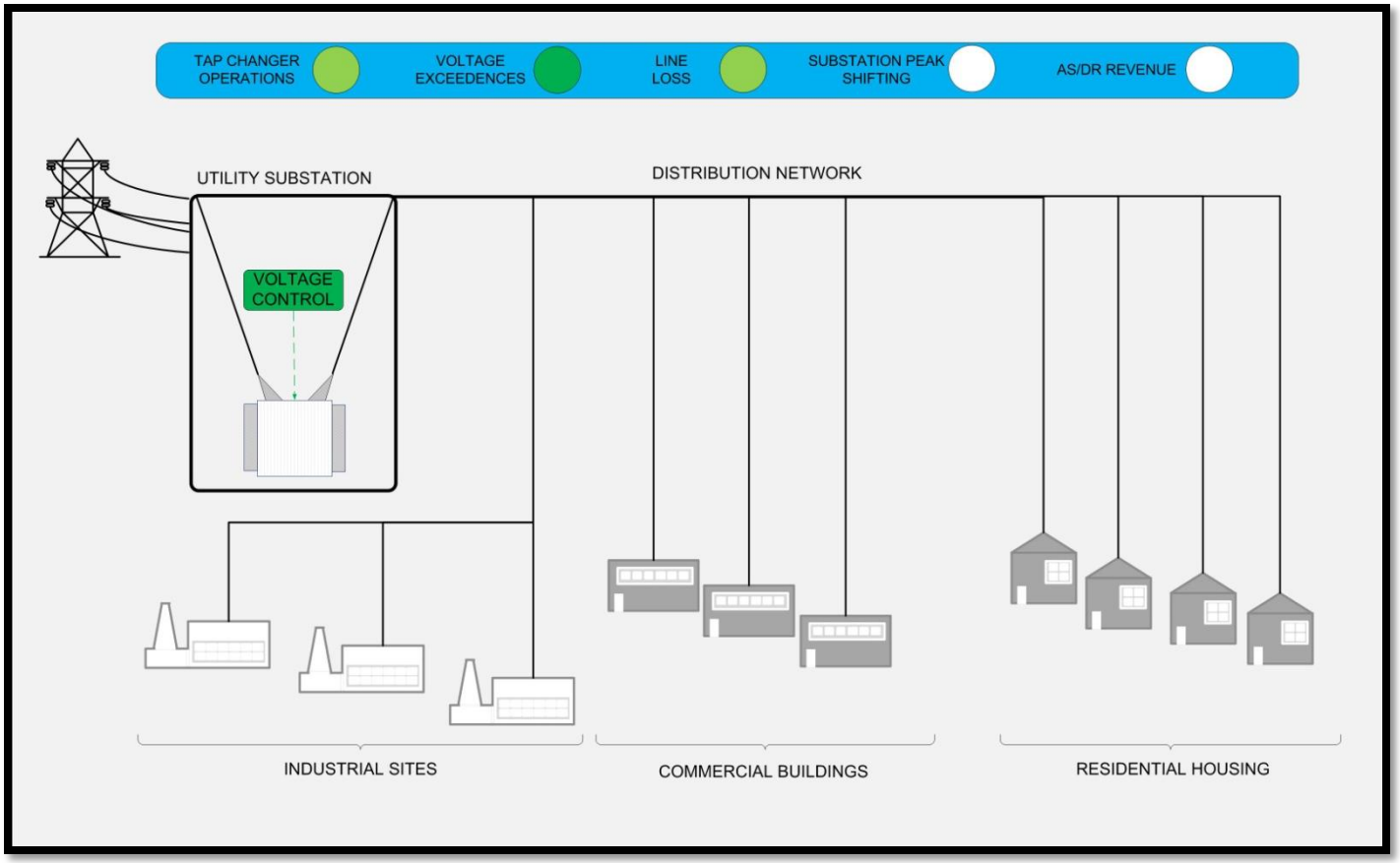
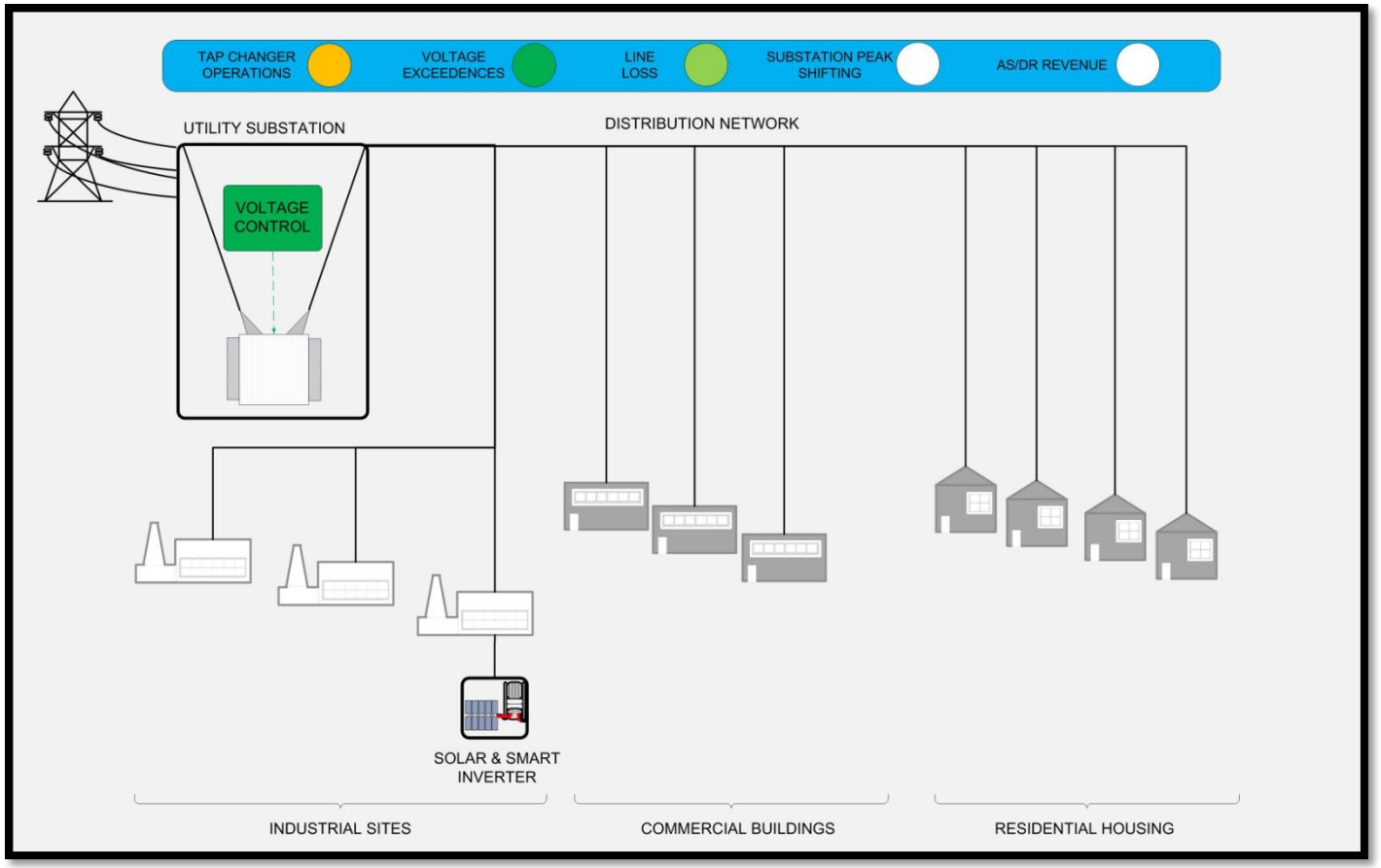
The Control Concept

- Distributed generation can create local voltage and power abnormalities
- These need to be addressed locally, rather than remotely
- Frequent polling (1 second) data collection from all large DER sites, all large load sites and all storage facilities on a feeder
- Local management of issues fully optimized in conjunction with utility systems and managed by the utility
- Optimization of the P and Q quantities for all sites on a 5 second basis
- Targets sent to all sites after each optimization

Base Case – Distribution Feeder No Solar



Limited Solar Penetration Scenario



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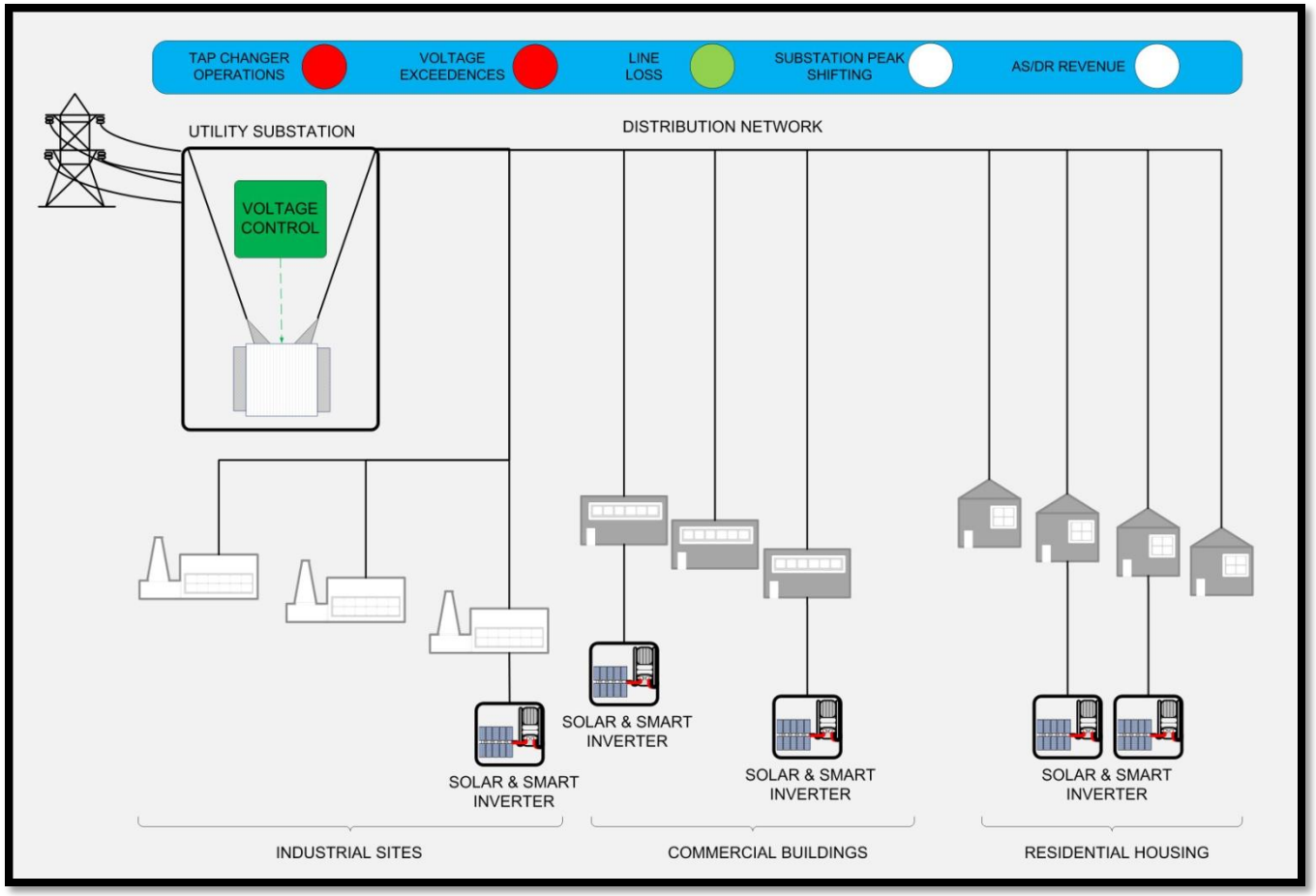
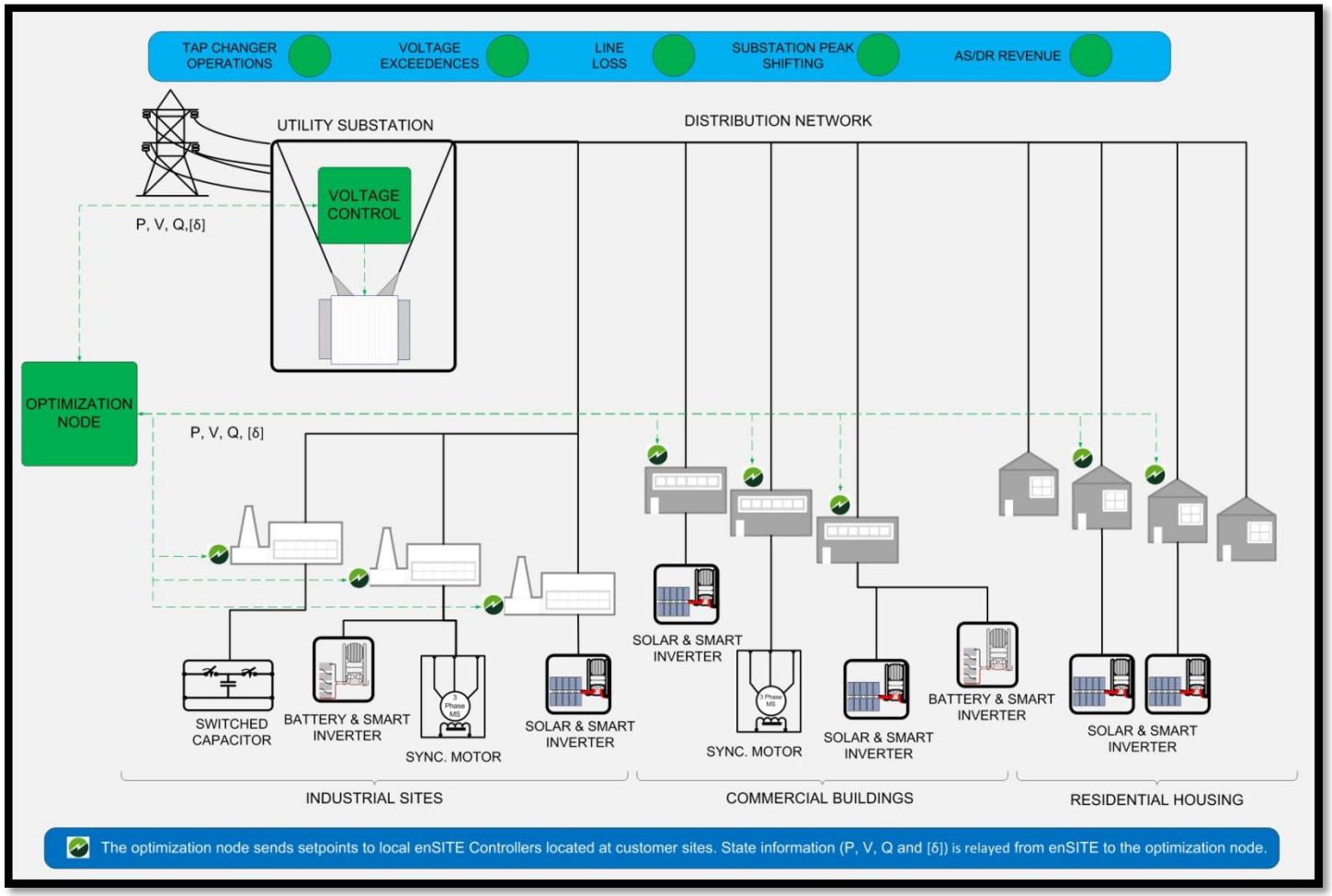
High Solar Penetration Scenario



Voltage Management – Coordinated Control



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Benefits

- Improved power quality for all customers
- Increased DER penetration
- Reduced line loss
- Potential substation/feeder upgrade deferrals
- Reduced utility maintenance on voltage regulation systems (tap changers)
- Improved Safety – positive indication from multiple sites that the line is de-energized, with potential for control of grounding switches

Questions

Steve Fine
703-934-3302
Steve.Fine@icfi.com

Malcolm Metcalfe
604-788-4004
mmetcalfe@enbala.com